USN FLEET CORROSION CONTROL

"Future Navy Needs for Corrosion Control & Maintenance"

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Report Documentation Page

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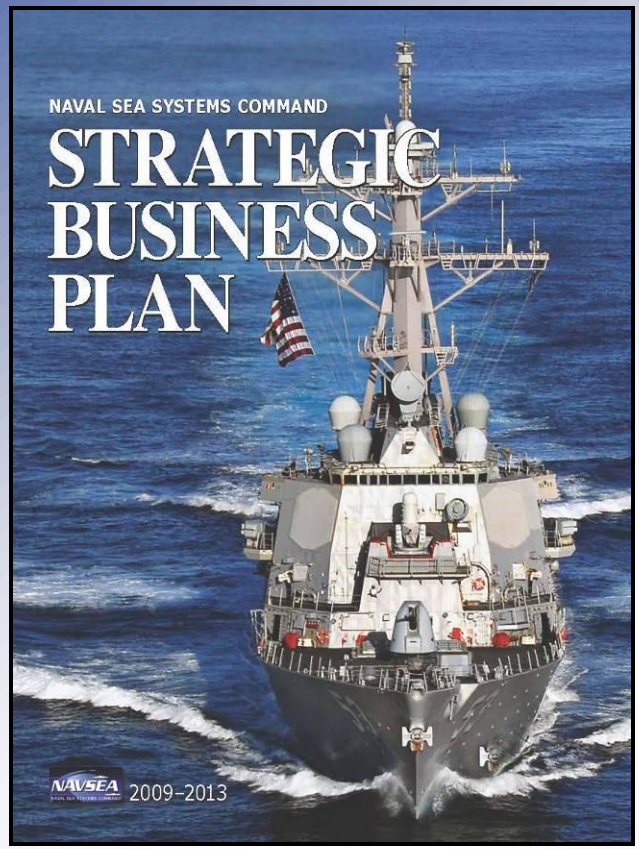
The NAVSEA Strategic Business Plan: Aligned for Success!



Secretary of the Navy

- Provide Total Naval Workforce
- Prosecute Global War on Terrorism
- Build the Force for Tomorrow
- Safeguard People
- Strengthen Ethics
- Provide First-Rate Facilities

Chief of Naval Operations

- Build a Navy for Tomorrow
- Maintain Current Warfighting Readiness
- Provide for Our People

Naval Sea Systems Command

- Build an Affordable Future Fleet
- Sustain Today's Fleet Efficiently and Effectively
- Enable Our People

Key Initiatives

- **Shipyard "Back to Basics"**
  - **Improve SSN 688 availability execution**
- ***Virginia* Class lifecycle cost reduction**
- **Eliminate cumbersome work practices and introduce new technology for submarine maintenance**
- **Reduce the cost of specifications**

Seawater Tank Condition Monitoring For Submarine Availability Pre-Planning

USS TOPEKA - Electro-chemical reference cell and data logger installation

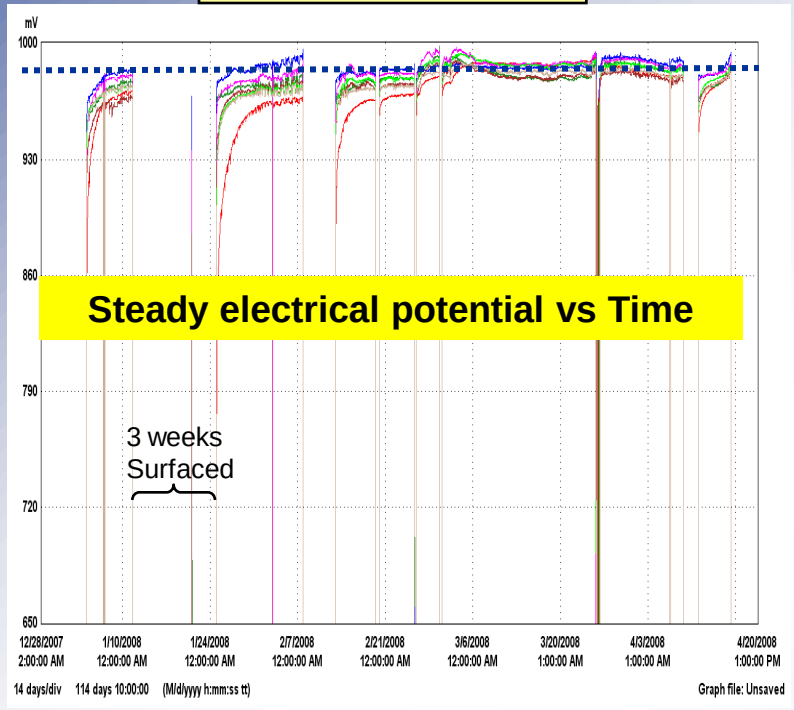
Prototype Instrumented Zinc

USS MINNEAPOLIS/ST PAUL – Portable Optical Inspection Device on Permanent Mounts

Tank Monitoring System

Corrosion Sensor Data

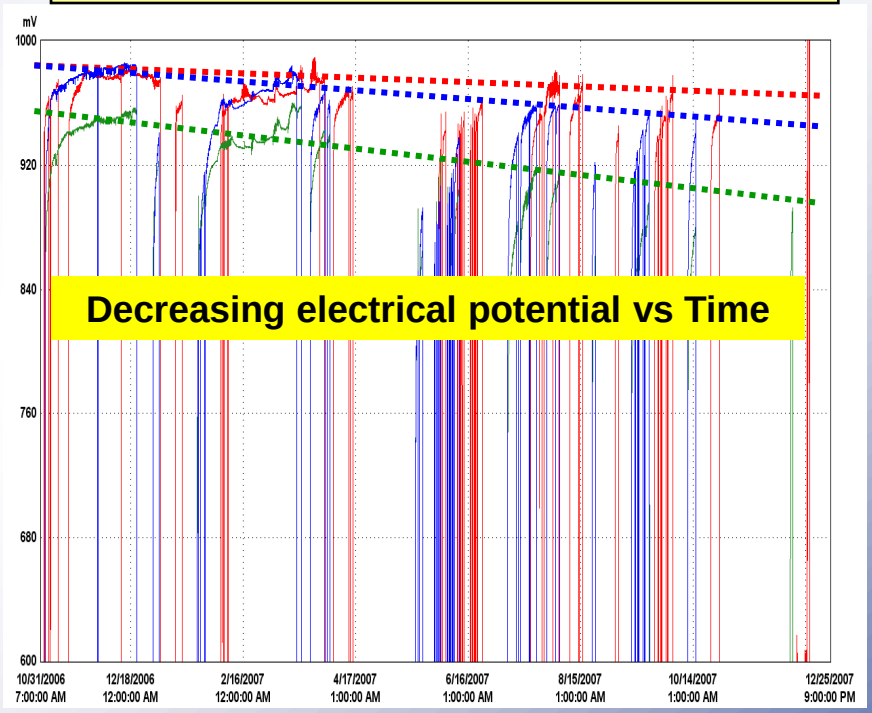
USS TOPEKA



Increasing Protection

Increasing Protection

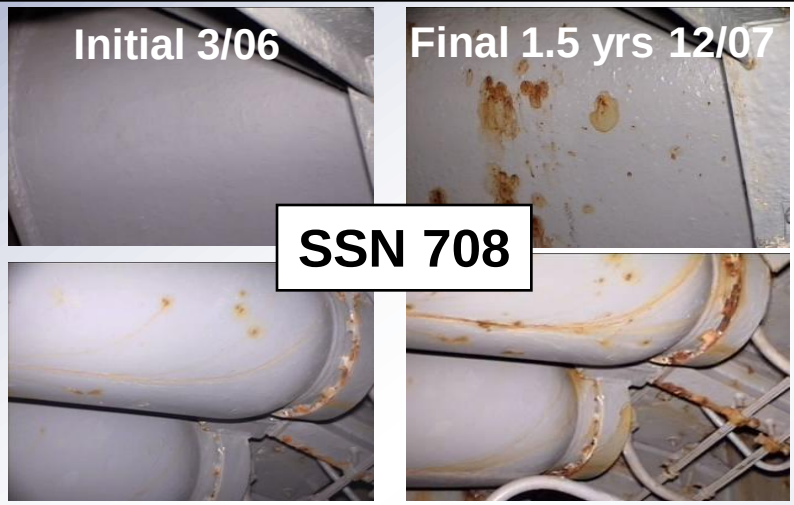
USS MINNEAPOLIS ST PAUL



Sherwin Willaims Duraplate – High Solids - Good Performance

Mare Island 24441 – Legacy Navy Epoxy Decreasing Performance

TMS Optical Inspection



% Damage Analysis
Camera Location

MBT 3A

	3/06	6/06	12/07
1:	0.2%	0.9%	1.3%
2:	0.4%	1.0%	1.2%
3:	0.7%	1.5%	1.8%

MBT 4A

	3/06	6/06	12/07
1:	0.2%	0.3%	0.7%
2:	0.3%	0.5%	0.6%

Mare Island Paint Installations

MBT 2A

	9/06	4/07
1:	<.05%	0.1%
2:	0.4%	0.1%

MBT 3A

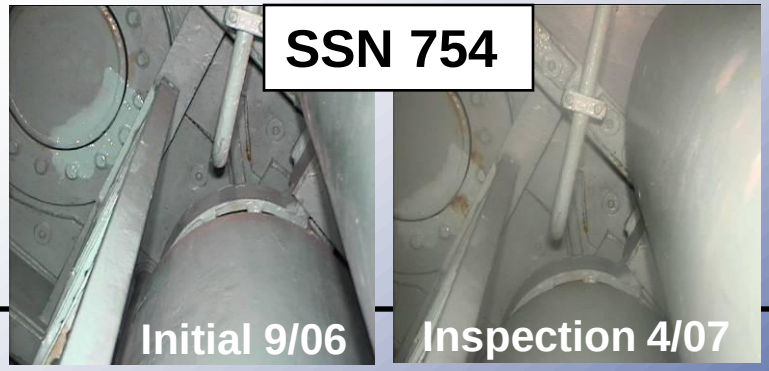
	9/06	4/07
1:	0.1%	0.1%
2:	0.2%	0.2%

MBT 3B

	9/06	4/07
1:	0.3%	0.2%
2:	0.1%	0.1%

MBT 4A

	9/06	4/07
1:	0.3%	0.2%
2:	0.2%	0.1%
3:	0.3%	0.2%



MBT 5A

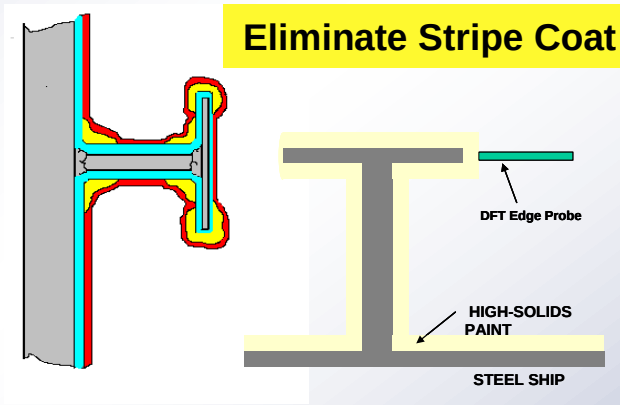
	9/06	4/07
1:	0.2%	0.2%
2:	0.2%	0.2%

Eliminating Cumbersome Work Practices

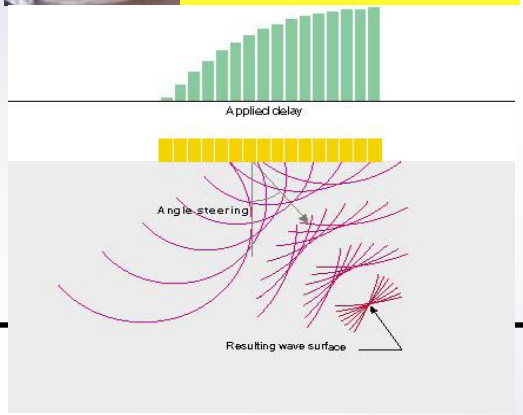
Induction Heat

Single Coat

Eliminate Stripe Coat



Phased Array UT



SSTG Slip Ring Resurfacing Without Steam

Surface Condition Measurement Tools

Documents Targeted for Technical/Cost Review

- Build an affordable future Fleet by reducing the cost of our specifications
- Study Guides developed to assist Technical Warrant Holders (TWHs) in the investigation
- Request For Information (RFI) posted on FEDBIZOPS
- TWHs performing fact finding investigations
- Identify cost savings while maintaining mission requirements
- Perform a risk assessment and present to NAVSEA leadership for recommendations and acceptance
- With consensus the documents will proceed into revision

Identify the full cost of our specifications

Documents Targeted for Technical/Cost Review

- MIL-S-901 Shock Tests, High Impact, Shipboard Machinery, Equipment, and Systems / Shock Technical Area
- MIL-STD-167-1Test Method Standard “Mechanical Vibrations of Shipboard Equipment / Vibration Technical Area
- MIL-STD-740-1& 2 Airborne sound Measurements / Structureborne Vibratory Acceleration Measurements and Acceptance
- MIL-STD-1689 Fabrication Welding and Inspection of Ships Structure, MIL-STD-278 Fabrication Welding and Inspection, and Casting Inspection and Repair for Machinery, Piping, and Pressure Vessels
- MIL-M-17060 Motors, 60 Cycle, Alternating Current, Integral HP, Shipboard Use
- MIL-DTL-16036 Switchgear, Power, Low Voltage, Naval Shipboard in conjunction with use of MIL-Spec circuit breakers (MIL-C-17587, MIL-C-17361)
- MIL-STD-777 Schedule of Piping, Valves, Fittings and Associated Piping Components for Naval Surface Ships
- MIL-STD-461E Electromagnetic Interference (EMI)
- MIL-STD 464A Electromagnetic Environmental Effects (E3) Requirements for Systems
- MIL-STD-469B / NTIA Chapter 5 Radar Engineering Interface Requirements, Electromagnetic Compatibility

Identify the full cost of our specifications

Future Focus

- Affordability
- Fleet Readiness
- Effective Execution of Programs
- Efficient Use of Tools
  - Design
  - Inspection
  - Monitoring
- Technical Knowledge & Capability

Technical Knowledge, Capability & Tools

- Use of Non-traditional Alloys
  - Aluminum Structure
  - High Strength
- New Applications
  - Reduced Conservatism & Redundancy
  - Mixed metals
  - Extended Service Life
  - Added Environmental Stressors
- Reliance on Risk Analysis
  - Knowledge
  - Tool Sets

NAVSEA Support of S&T Efforts

- **ONR**
  - √ FNC CBM Tank Monitor System – **Successful Investment**
  - √ FNC EPE Single Ship Tank Coatings – **Successful Investment**
  - – FNC EPE High Performance Coatings
    - Non-Skid Coatings for High Durability and Temperature Resistance
    - Advanced Topside Coatings for Increased Life
    - High Performance Rudder Coatings
  - – FNC EPE Corrosion and Corrosion Related Signature Technologies for Improved Operational Availability
    - Real Time Hull Condition Assessment
    - Robust ICCP Anodes & Reference Cells
    - Redesign of Active Shaft Grounding
  - – Proposed Innovative Naval Prototype Program for "*Maintenance Free Ship*"
    - Integrated Hull Shield
    - Transformational Interior Architecture
    - Engineered Topside & Freeboard Architecture
- **DARPA**
  - – Naval Advanced Amorphous Coatings
  - – Cavitation Resistant Alloys for Naval Propulsion

Single Coat Rapid Cure

SY	Ship	Tanks
Portsmouth	USS Greeneville SSN 772	All seawater tanks & voids
Norfolk	USS Harry S. Truman CVN-75	20 tanks & voids
	USS Norfolk SSN 714	No good candidates
	USS Tennessee SSBN 734	MBT 5A
	USS Boise SSN 764	No good candidates
Puget Sound	USS San Francisco SSN 711	Partially implemented - various tanks
	USS Jimmy Carter SSN 23	Partially implemented - various tanks
	USS Michigan SSGN 727	Partially implemented - various tanks
	USS Seawolf SSN 21	Plan to fully implement in AUG 09
Pearl Harbor	USS Cheyenne SSN 773	Aux 1&2, WRT 1&2, FTT, Sail
	USS Houston SSN 713	No painting required
	USS La Jolla SSN 701	TBD
Private Yards	Various contract work	Working to implement single coat

Disposable Paint Cartridge Dispensing Systems

DESCRIPTION: **Transition commercially developed disposable paint cartridges dispensing systems for Fleet and or Depot use. Provide Fleet/Depot with advanced coating technology, coupled with ease of disposal configuration. Replace current equipment and HAZMAT disposal methods.**

APPLICATION: **Surface ships, submarines, and vehicles.**

ROI ESTIMATE: **23.27**

IMPLEMENTATION SCHEDULE	1 QTR	2 QTR	3 QTR	4 QTR
Schedule Demonstration Visits at Depots				|----→
Visit Depots				|----→
Calculate Metrics				|----→
Issue Progress Report				
Issue Final Demonstrations Report				
Transition Technology				X
Issue CID “Manual Dispensing Gun”				X
Identify“Paint Sprayer” Fesability				X
Identify “Power Roller” Fesability				X
Draft Update for NAVSEA Std Item 009-32				X
Draft Update for USMC Specifications				X
Issue NSNs				X

ASSESSMENT

2009	Jan	Apr	Jul	Oct
TECHNICAL				
MANAGEMENT				
OVERALL				

ACCOMPLISHMENTS/HIGHLIGHTS

- ESTABLISHED PROJECT TEAM
  - NSWCCD\NRL
  - PUGET SOUND NAVAL SHIPYARD
  - PORTSMOUTH NAVAL SHIPYARD: Visited 10 SEPT’08 reviewed developments/issues.
- DEVELOPED DEPOT AND SHIPBOARD EVALUATION PLAN
- WORKING CARTRIDGE APPLICATION TECHNOLOGIES (CAT)WITH SPRAY SYSTEMS OCTOBER

Corrosion Performance of AA5xxx and AA6xxx Alloys in Naval Environments

Background

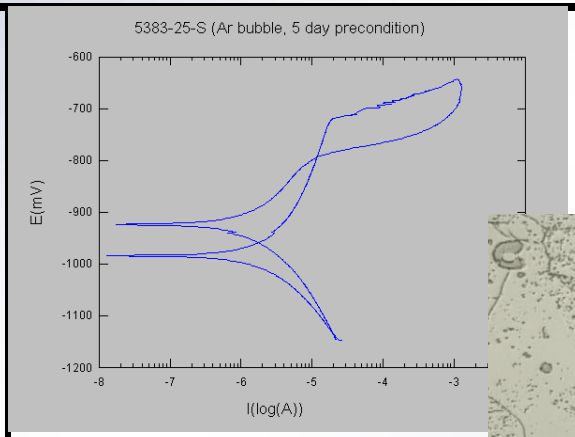
Sea Power 21 requirements for high speed craft

- Littoral Combat Ship (LCS)
- Ship-to-Shore Connector (SSC)

Aluminum 5xxx alloys suffer from various forms of corrosion including exfoliation, intergranular corrosion, sensitization, weld/heat affected zone (HAZ) corrosion, and environmentally assisted cracking

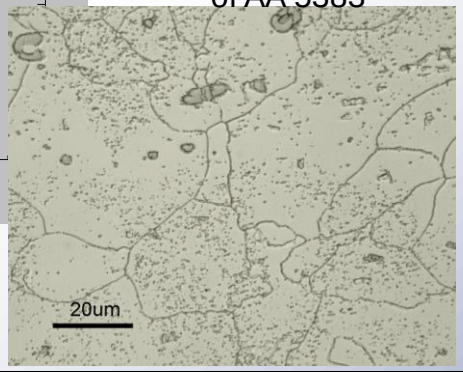
Objective

Develop a set of laboratory tests that quantitatively characterize the performance of selected aluminum alloys in the Navy operational marine environment



Potentiodynamic scan for sensitized AA5383

Sensitized microstructure of AA 5383



APPROACH

Perform accelerated laboratory testing on base material and welds

- ASTM G66 and ASTM G67
- Potentiodynamic characterization

Characterize corrosion performance of alloys in natural seawater environment

Determine relationships between accelerated tests and long term performance

Develop capability to predict long term performance from laboratory tests

IMPACT

Reduce risk associated with the use of aluminum alloys in Naval structural applications

Rapid evaluation of new aluminum alloys

Basis for non-destructive method to determine degree of sensitization in service

PROGRESS

Performed G66, G67 and potentiodynamic testing on base metal and welds in as-received and sensitized conditions

Analyzing characteristics of potentiodynamic curves indicative of degree of sensitization

Initiated long term natural seawater exposure

COMPOSITE CONNECTORS/CONDUIT

DESCRIPTION: Replace metallic conduits/connectors that: corrode, require frequent repainting, & cause electrical equipment failure with composite connectors/conduits that do not corrode & require no topside maintenance.

APPLICATION: Weapon systems: Navy surface ships, MSC ships, & Army watercraft.

ROI ESTIMATE: 12:1

MILESTONE SCHEDULE

	FY 07	FY08	FY09
Establish Working Group	XXX		
Formulate Preliminary Design	XXXX		
Initial Shipcheck	X		
Approve Design	XX		
Manufacture Prototype		XXXXXXXX	
Conduct Certification testing		XXXXXXXXXXXX	
Conduct ship demonstrations		XXXXXXXXXXX	
Draft changes to MIL-PRF-24758A		XXXXXX	
Conduct Final ship installation check		XX	

ASSESSMENT

2008	Jan	March	June	Sept
TECHNICAL				
MANAGEMENT				
OVERALL				

ACCOMPLISHMENTS/HIGHLIGHTS

- COMMERCIAL ITEM DESCRIPTION (CID) COMPLETED FOR CONDUIT INSTALLATION. SHIPCHECK OF SHIP DEMONSTRATION JUNE 2008
- DESIGN AND MANUFACTURING OF CORROSION RESISTANT, LIGHT WEIGHT COMPOSITE CONNECTOR HAS BEEN COMPLETED
- TESTING OF COMPOSITE CONNECTOR FOR MIL-PRF-24758A REQUIREMENTS ARE COMPLETED. ONE TEST NEEDS TO BE REPEATED
- INSTALLATION OF SHIP DEMONSTRATIONS ON DDG-52 AND CG-72 IS COMPLETE AND SHIPS HAVE DEPLOYED. NEED TO COMPLETE RETURN INSPECTION

SELF CLEANING COATINGS

DESCRIPTION: **To determine if commercially available self-cleaning coatings and materials will be cost effective and eliminate need for cosmetic painting in areas where running rust is a problem.**

APPLICATION:

Weapon systems: Navy surface ships, Army and U.S. Marine Corps vehicles

ROI ESTIMATE: 1074:1

MILESTONE SCHEDULE

Implementation Schedule	Q1	Q2	Q3	Q4
Identify commercially available candidate coating systems	<--------->			
Review coating system's MSDS for compliance with environ,	<---------->			
Gather preliminary coating data from manufacturers and		<---------->		
Testing 5 coatings, 1 powder coat, and two polyurethane tapes			<---------->	
Modify performance specification sections for Mil-Prf 24635 and submit for approval			<----------X	

ASSESSMENT

2008-2009	NOV	DEC	JAN	FEB
TECHNICAL				
MANAGEMENT*				
OVERALL				

***Funding received on first week of January 08**

Green: No disruption on costs, scheduling, and performance.

Yellow: Potentially may cause some disruptions (e.g. scheduling, increases in cost, degradation of performance, etc.).

Red: Likely to cause disruptions (e.g. scheduling, increases in costs, etc.).

ACCOMPLISHMENTS/HIGHLIGHTS

- Draft the end of FY08 technical report for reporting test results and analyses.

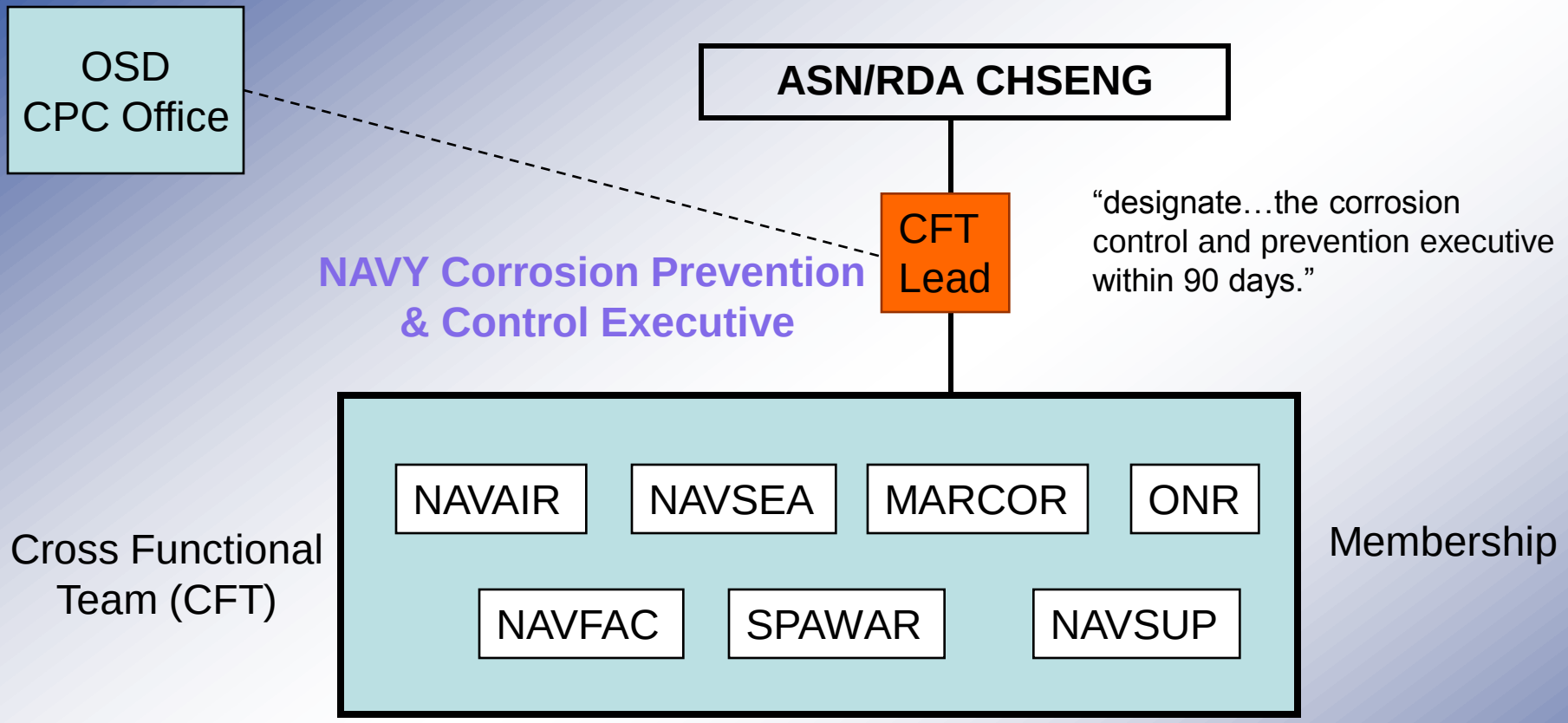
Summary

- Historically the Corrosion Community is well aligned with Program and Fleet needs
- Investment in Technical Capability is essential and dependent on S&T Programs
- Focus
  - Reduce Costs of Future & Legacy Fleet
  - Improve Our Understanding of Risk Factors

New in 2009

Corrosion Prevention and Control (CPC) Cross Functional Team (CFT)

NAVY Corrosion Prevention & Control (CPC) Team



National Defense Authorization Act for Fiscal Year 2009
Sec. 903, signed 14 Oct 2008, & 10 USC 2228